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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/786,107	02/26/2004	Hiroyasu Ito	01-149-DIV	4240

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POSZ LAW GROUP, PLC
12040 SOUTH LAKES DRIVE
SUITE 101
RESTON, VA 20191

EXAMINER

THOMAS, TONIAE M

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 06/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/786,107

Applicant(s)

ITO ET AL.

Examiner

Toniae M. Thomas

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 15-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 15-20 and 22-24 is/are rejected.
- 7) ☒ Claim(s) 21 and 25-28 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 February 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☒ Certified copies of the priority documents have been received in Application No. 09/865,704.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 02/26/04.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

1. This is a first Office action on the merits of Application Serial No. 10.786,107, which is a divisional of Application Serial No. 09/865,704.
2. The preliminary amendment filed on 26 February 2004 cancelled claims 1-14. Accordingly, claims 15-28 are pending.

Drawings

3. Figure 3B should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 18 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 18 recites the limitation *said each ion implantation of the impurities is carried out under one of conditions that a dose is equal in the each ion and that a dose in the each ion implantation is smallest in ion implantation with lowest acceleration energy*. The meaning of the recited portion *a dose is equal in the each ion* is unclear (claim 18, line 4). For purposes of examination, the limitation is interpreted to mean that under one condition, the implant dosage in each ion implantation is equal.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 15-20, and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (US 6,110,799) in view of Hsieh et al. (US 5,907,776).¹

The Huang patent (Huang) discloses a method of manufacturing a semiconductor device (figs. 1-9 and accompanying text). The method comprises: forming a second conductivity type (P-type) region 14 in a semiconductor substrate 10, the substrate having a principal surface of a first conductivity type (N-type) (fig. 1 and col. 2, lines 1-5); forming a first

conductivity type region 16 inside the second conductivity type region, the first conductivity type region having a higher concentration than the substrate (fig. 2 and col. 2, lines 6-8); forming a plurality of first trenches 20, 22 in a depth direction of the substrate by anisotropic etching (fig. 3 and col. 2, lines 9-12);² forming an insulation film 24 in an interior of each of the first trenches (fig. 4 and col. 2, lines 14-17); filling each of the first trenches with a polycrystalline silicon film 26 (fig. 5 and col. 2, lines 18-21); forming a plurality of second trenches 34 in the second conductivity type region each positioned between an adjacent pair of first trenches in parallel with the first trenches (fig. 8 and col. 2, lines 29-35);³ forming a second conductivity type protrusion region 35 with a junction deeper than a junction of said second conductivity type region by introducing impurities of the second conductivity type from each of the second trenches (fig. 8 and col. 2, lines 34-38); and forming a metal electrode 36 so as to electrically connect the first conductivity type region with the second conductivity type protrusion region in each of the second trenches (fig. 9 and col. 2, lines 38-42).

Huang lacks anticipation of forming a "sacrificed" oxide film on an inner surface wall of each of the first trenches by thermal oxidation, and removing

¹ Applicant submitted both the Huang patent and the Hshieh patent as prior art. See the information disclosure statement filed on 26 February 2004.

²An anisotropic etching process is a directional etching process, i.e. it occurs substantially in a single direction, either laterally or vertically. Huang discloses etching the trenches using a process that etches "downwardly," which indicates that the etching occurs in only a vertical direction. Thus, the etching process is an anisotropic process.

the “sacrificed” oxide film. However, the Hshieh et al. patent (Hshieh) discloses a method of manufacturing a semiconductor device, wherein the method comprises: prior to forming an insulation film 44 in an interior of a plurality of trenches 38, forming a sacrificial oxide film 76 on an inner surface wall of each trench by thermal oxidation, and removing the sacrificial oxide film (fig. 7D and col. 6, lines 32-35).

In Hshieh, the formation and subsequent removal of a sacrificial oxide film provides a smooth trench surface for subsequent gate oxide growth (Hshieh - col. 6, lines 39-45). Thus, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify Hshieh by forming a sacrificial oxide film on and subsequently removing from an inner surface wall of each of the first trenches, as taught by Hshieh, since doing so provides a smooth trench surface for the subsequent growth of insulation film 24.

Huang does not teach that the second conductivity type region 14 and the second conductivity type protrusion region 35 are formed by two or more ion implantations. However, it would have been obvious to the skilled artisan, at the time the invention was made, to modify the combination of Huang and Hshieh, by doping the second conductivity type region 14 and the second conductivity type protrusion region 35 using multiple ion implantations

³ Figure 8 shows only a single second trench. However, the structure of fig. 8 forms part of a memory cell array (col. 2, lines 56-58). Thus, it is inherent that Huang forms a plurality of trenches.

because multiple ion implantations provide a desired dopant concentration gradient for both the region 14 and the region 35.

Huang lacks anticipation the implant energy and dosage recited in claims 17-19, 22, and 23. However, such process parameters would have been obvious to one skilled in the art, at the time the invention was made, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

Allowable Subject Matter

6. Claims 21 and 25-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (571) 272-1846. The examiner can normally be reached on Monday through Friday from 8:30 a.m. to 5:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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TMT

26 June 2005

A handwritten signature in black ink, appearing to read 'Mary Wilczewski', with a stylized flourish at the end.

Mary Wilczewski
Primary Examiner